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FIRST DOCUMENTED RECORD OF *CAREX GRACILLIMA* (CYPERACEAE) IN MISSOURI IN 112 YEARS

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Carex gracillima Schwein. (graceful sedge) is widely distributed in eastern North American and extends from Newfoundland west to Manitoba and North Dakota and south through the Great Lakes to Arkansas, Alabama, and Georgia (Voss, 1972; Gleason and Cronquist, 1991; Hyatt, 1993, 1998; Yatskievych, 1999; Association for Biodiversity Information, 2001; Wetter et al., 2001). Although the species is globally ranked by the Nature Conservancy as G5 ("demonstrably wides-pread, abundant, and secure globally, though it may be quite rare in parts of its range, especially at the periphery"), the species is listed as S1 ("critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state; typically 5 or fewer occurrences or very few remaining individuals") in Missouri, Arkansas, and North Dakota (Missouri Department of Conservation, 2001; Association for Biodiversity Information, 2001). In Missouri, the species was known historically only from two collections taken in St. Louis and Greene counties in 1887 and 1889, respectively (Steyermark, 1963; Yatskievych, 1999; Missouri Department of Conservation, 2001). Mike Currier of the Missouri Department of Natural Resources apparently collected a fragmentary specimen from the Lamine River Conservation Area in Cooper County in 1997, but this was lost and Currier failed to relocate the population during repeated searches for the sedge (M. Currier, pers. comm., July 2001). Consequently, this report documents the occurrence of the species in Missouri for the first time in 112 years.

Habitat requirements for *C. gracillima* are extremely variable. The species occurs in a wide range of wooded habitats and can be found on moist and dry substrates in both deciduous and coniferous forests. Habitats listed for the species include "rich and low woods"

(Radford et al., 1964); "rich woodland or edges of woods and streams" (Hinds, 1986); dry to moist woods (Rhoads and Klein, 1993, Mohlenbrock, 1999); "mesic, wooded slopes and alluvial woods" (Eilers and Roosa, 1994); and "...on moist north-facing rock outcrop, mesic deep valley below sandstone bluff at dripping waterfall" (Hyatt, 1998). Voss (1972) provided the following habitat description and information for the species in Michigan: "A common sedge of woods, especially beech-maple, moist oak or oak-hickory stands, edges of woodland ponds or streams, and mixed swampy woods; northward, also in coniferous swamps (cedar, fir, spruce, tamarack), particularly along trails and clearings and at borders of bogs." In Missouri, Yatskievych (1999) listed the habitat for the species as: "bottomland forests, margins of streams."

On 27 June 2001, while assisting with a larval research project for the federally endangered Hine's emerald dragonfly (*Somatochlora hineana*) at The Nature Conservancy's Grasshopper Hollow Fen preserve in Reynolds County, Missouri, I discovered a large population of this sedge along a rich floodplain bordering a small stream just west of the main fen opening. The species was associated with *Bromus nottowayanus, B. pubescens, Carex hirtifolia,* and *Lindera benzoin.* I returned to the location on 28 June to determine the limits of the population and obtain a rough estimate of the number of clumps present. *Carex gracillima* was scattered along the stream and its main tributary for a few hundred m and extended onto adjacent land managed by the U.S. Forest Service. Due to time constraints, I halted my search after estimating at least 200 separate clumps. Culms of *C. gracillima* were three to four times longer than the basal clumps of leaves. The culms were rather delicate and were supported by adjacent vegetation or laid on the ground where they were often bent from wind or water. This characteristic, coupled with the delicate, long (to 6 cm), drooping peduncles with as many as 25 perigynia scattered along their length, gives the species a distinct field appearance that reflects well its common name of "graceful sedge".

The pendulous and narrow cylindrical spikes enable even the beginning "careologist" to place this species in section Hymenochlaenae (Drejer) L.H. Bailey, which includes *C. cherokeensis, C. davisii, C. debilis, C. oxylepis, C. prasina,* and *C. sprengelii.* With the exception of the common and widespread *C. davisii*, all species within this section in Missouri are listed as S1 or S2 ("imperiled in

the state because of rarity or because of some factor(s) making it vulnerable to extirpation from the state; 6 to 20 occurrences or few remaining individuals or acres") species on the Missouri Department of Conservation's *Missouri Species of Conservation Concern Checklist* (Missouri Department of Conservation, 2001). *Carex gracillima* can be distinguished easily from other members of the section Hymenochlaenae by the combination of glabrous leaf sheaths and blades, the beakless perigynia, and in having a few perigynia at the distal end of the staminate spikes.

VOUCHER DATA- Reynolds County: Grasshopper Hollow Fen Natural Area, ca. 1.3 mi. NE of intersection of Routes 72 and TT; T32N R1W Sec. 30 NW¼ of SW¼ of SE¼, GPS (WGS1984) coordinates: Latitude 37°25' 59.34240"N; Longitude 91°05'32. 06903"W, 27 June 2001, *P.M. McKenzie 1955* (MO, MICH, UMO, Charles Bryson, U.S. Forest Service).

Because specimens at the site were overly mature (i.e., most of the perigynia had shattered) on 27-28 June 2001, no additional surveys were conducted in the area during the 2001 field season. An expanded survey is planned for 2002, and it is likely that it will result in the discovery of additional populations in adjacent drainages. Botanical nomenclature listed herein follows Yatskievych (1999), except for *Lindera benzoin,* which follow Yatskievych and Turner (1990).

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A SECOND LOCALITY FOR *ARUM ITALICUM* (ARACEAE) IN MISSOURI

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Hudson (1995) reported *Arum italicum* Mill. from a disturbed, mesic, upland forest in Popular Bluff (Butler County). He suggested that these plants had become naturalized from a nearby garden. A new locality for *Arum italicum* is reported from a site near Valley Water Mills just northeast of Springfield (Greene County). There are a dozen or more plants scattered along a north-facing mesic forest just south of the South Dry Sac River (T29N R21W Sec. 5, elevation ca. 380 m). The plants were growing in rocky soil at the base of a small limestone bluff.

As with the collection from Butler County, these plants appear to have escaped from a garden area on the small bluff above. They appear to be healthy and most had flowered by the time that a voucher specimen (*Redfearn 40035*, SMS) was collected on 24 May 2001.

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WOOD LILY REDISCOVERED IN MISSOURI

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In June 1838 and again in June 1878, single specimens of the wood lily (*Lilium philadelphicum* L.) were collected in the vicinity of St. Louis. According to the herbarium labels, the first specimen was collected by Henry Eggert from woods west of Forest Park, and the second by Nicolas Riehl from forest in St. Louis city. For 122 years, these two occurrences constituted the entire Missouri record for the species. On June 13, 2000 the author and Department of Conservation Wildlife Management Biologist Micheal Jones discovered a small population at Morris Prairie in Sullivan County. Morris prairie is owned by Ken and Marlene Morris and the wood lily "discovery" was actually a confirmation of a 1991 sighting of the plant by Mrs. Morris. Her description of an unknown plant that she had seen matched that of the wood lily, but several searches in subsequent years failed to locate the plant, so its existence went unconfirmed for nine years.

In his *Flora of Missouri*, Steyermark (1963) does not include *L. philadelphicum* as a member of Missouri's native flora. However, the revision of this publication (Yatskievych, 1999) includes a variety of the species, *L. philadelphicum* var. *andinum* (Nutt.) Ker Gawl., based on the two historical collections from St. Louis cited above. A more recent manuscript treatment of the genus by Mark Skinner (in press) does not support maintenance of this variety.

Morris Prairie is located in northeastern Sullivan County near the Putnam County line. It is one of the highest quality prairies in northern Missouri and supports more than 200 native plant species. In addition to the wood lily, Missouri species of conservation concern (Missouri Department of Conservation, 2001) at the site include: auriculate false foxglove (*Agalinis auriculata*), pale gerardia (*Agalinis skinneriana*), tall agrimony (*Agrimonia gryposepala*), and dwarf chinkapin oak (*Quercus prinoides*). Bunchflower (*Melanthium virginicum*), prairie dropseed (*Sporobolus*

hetero-lepis), prairie plantain *(Cacalia tuberosa*), Indian paintbrush (*Castilleja coccinea*), and porcupine grass (*Stipa spartea*) are other regionally uncommon species found in the prairie.

The Morris's acquired the prairie in 1984. Management during the initial years of their ownership consisted of haying and seasonal grazing. Based on conversations with the previous owner, as well as an evaluation of the site, earlier management apparently included grazing (at times heavy), haying, and tillage of a couple of small sections of the tract. The formerly cropped sites now support a of mix of native and exotic grasses, and past grazing effects are evident elsewhere in the scattered small, eroded pockets, as well as the somewhat altered species composition and distributions.

The Department of Conservation began assisting with the management of Morris Prairie in the early 1990s. Shortly thereafter, grazing and haying were halted as part of a management plan to improve the quality of the prairie. Prescribed burns were conducted in 1994, 1999, and 2000. These burns appear to have significantly improved the abundance and distribution of characteristic prairie plants. Additionally, in 2000, approximately 6 acres of encroaching trees and brush were cut, initiating the restoration of these areas to prairie vegetation.

We found wood lily in three locations within a 30 m band on an upper south-facing slope, with 1, 2, and 7 stems present. All plants were in late flower or early fruiting stage. Because of the small number of stems we did not collect a specimen. However we did take several photos of the plants which were subsequently verified by George Yatskievych of the Flora of Missouri Project, Missouri Botanical Garden.

The lilies are located in a small corner of the prairie (4–5 acres) that apparently had a less intensive use history than the rest of the site. Old aerial photos indicate a fence line separating this parcel from the rest of the prairie, and we speculate that its management consisted of annual haying and little or no grazing. As a con-sequence, this small area is somewhat more diverse than the balance of the prairieand includes good populations of grazing-sensitive species such as leadplant (*Amorpha canescens*), finger coreopsis (*Coreopsis palmata*), and New Jersey tea (*Ceanothus americana*).

Yatskievych (1999) describes *L. philadelphicum* as having: "...aerial stems 30–80 cm long, and leaves that are 3–10 cm long,

essentially glabrous, mostly alternate but whorled on at least the uppermost node(s), and linear to narrowly elliptic or narrowly lanceolate." Inflorescences are whorls of 2–5 flowers, often reduced to a single flower. The flowers are erect and bell-shaped, with the sepals and petals ascending to spreading near the tips. *Lilium philadelphicum* is readily distinguished from the more common native lily, Michigan lily (*L. michiganense*), by the erect, deep orange/red flowers, shorter stature, and smaller leaves that are primarily alternate. Color photos of both *L. philadelphicum* and *L. michiganense* can be found in Ladd (1995).

According to Skinner (in press), *L. philadelphicum* is the widest ranging of our true lilies. Its range extends through the Appalachians, from northern Georgia into Canada, and westward to Illinois, North Dakota, and western Canada, and south to Missouri and New Mexico (Skinner, in press; Yatskievych, 1999). The documented locations nearest to Morris Prairie include a few southeastern Iowa counties that border Missouri (Christiansen and Muller, 1999) and Henderson County, Illinois, which borders the Mississippi River, one county north of the Missouri state line (Mohlenbrock and Ladd, 1978). In fact, from the nationwide range map provided by Skinner it would appear that the wood lily seemingly purposely avoided taking up residence in Missouri. Its range extends across Illinois roughly at the latitude of St. Louis, north along the Mississippi River to the confluence of Illinois, Iowa, and Missouri, and then due west along the Iowa/Missouri state line. Similarly, Christiansen and Muller (1999), show that the species is widely distributed across Iowa, occurring in perhaps two thirds of the counties, including a few in the southernmost tier.

Lilium philadelphicum is known from a broad range of habitats (dry open woodlands, dry and sandy prairies, moist or mesic prairies, powerline corridors, high mountain meadows), but probably the most frequently cited habitat for the species is rich, moist prairies. Perhaps most relevant to Missouri are habitat preferences provided in floras from Missouri's neighboring states. In Iowa, the species is known from "moist prairies" (Eilers and Roosa, 1994), and "moist to mesic prairies; also dry and sandy prairies" (Christiansen and Muller, 1999). In Illinois, Mohlenbrock (1986) lists the species habitat as "dry woodlands." The habitat at Morris Prairie would be classified as dry-mesic prairie, according to (Nelson, 1985).

Although Yatskievych (1999) indicated that the species was probably extirpated in the St. Louis area, he suggested that, "*Lilium philadelphicum* should be searched for in remnant prairies and forests in the Glaciated Plains of northern Missouri, as it occurs in adjacent northwestern Illinois and in southeastern Iowa." This sentiment proved accurate. Although there are very few additional high quality prairies or woodland/savanna habitats in northern Missouri, numerous areas exist that support some remnant of the original native vegetation. These areas, especially if they are brought under restoration management, may ultimately be found to contain additional populations of this newly rediscovered member of Missouri's native flora.

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A NORTHWARD EXTENSION OF THE KNOWN RANGE OF *GEOCARPON MINIMUM*

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The diminutive *Geocarpon minimum* Mack. (Caryophyllaceae) is one of the rarest plant species in Missouri and has been listed as a Federally Threatened species since June 1987 (Federal Register 52[115]:22930). Plants are small, up to 3 cm tall but generally much smaller, with somewhat fleshy leaves that are often reddish green or even purplish in color. The flowers are inconspicuous and are nearly the same color as the remainder of the plant. No other species is closely related, so it has been classified into its own genus.

Geocarpon has a geographical distribution that is largely confined to Missouri. The species was initially described from Jasper County (Mackenzie, 1914), but that population apparently has been destroyed. *Geocarpon* is presently known from 21 active populations in 6 southwestern Missouri counties: Cedar, Dade, Greene, Lawrence, Polk, and St. Clair (Tim Smith, Missouri Department of Conservation, pers. comm.) as well as in four counties in Arkansas and in one Louisiana parish. The majority of the plants outside of Missouri are in an area called "Warren Prairie" that straddles the Bradley/Drew County line in southeastern Arkansas (Moore, 1958). A single population exists in Franklin County, in northwestern Arkansas, (Smith, et al., 1984), but pairs of populations in close proximity are found in Cleveland County, southeastern Arkansas (Rettig, 1983) and Winn Parish in north-central Louisiana (McInnis, et al., 1991).

The rarity and disjunct distribution of *Geocarpon* doubtless stems from the unique habitat requirements of the species. In Missouri and northwestern Arkansas, all extant populations are confined to glades associated with the Pennsylvanian-aged "channel sands" sandstone formations, which formed in shallowed braided freshwater streams and can contain high concentrations of metallic cations. Generally, these glades are flat to gently sloping with extensive areas of exposed sandstone. *Geocarpon* occurs where the

soil is only a few cm thick and too thin and drought prone to support most other plant species. The southern Arkansas and Louisiana populations occur in saline prairies, which are savanna-like areas with soils containing such high concentrations of sodium and magnesium ions that the growth of woody vegetation is severely restricted. *Geocarpon* is limited to the edges of areas within these saline prairies known as "slick spots" where the alkaline ion concentrations are so high that other plants are unable to grow (Pittman, 1993). *Geocarpon* survives in narrow habitat zones where harsh conditions limit competition from other plant species but where slight alternations caused by erosion or siltation can destroy the habitat.

Geocarpon is able to occupy its unique habitat partially because it has a somewhat unusual life cycle known as winter annual. This life cycle features late autumn or winter germination followed by rapid growth and flowering in the early spring (Baskin and Baskin, 1985). *Geocarpon* begins blooming in March with the life cycle completed by mid-May, or as early as mid-April in dry years (Morgan, 1986). Dormant seeds survive the summer drought conditions on the glades.

A new population of *Geocarpon* was discovered on 20 December 1997 near Browington, in Henry County, Missouri, which represents a northward range extension for the species. The next- closest known populations occur in west-central and southern St. Clair County. The population was estimated to contain 325–350 individual when Tim Smith visited the glade on March 26, 1998. The Henry County sandstone glade is similar in appearance to that of other *Geocarpon* glades in southwestern Missouri.

The new *Geocarpon* population is on property owned by the Army Corps of Engineers (Corps) as part of the Truman Reservoir area, with the Missouri Department of Conservation (MDC) in charge of management. The Corps and MDC personnel are considering longterm management plans that could include burning or clearing brush surrounding the *Geocarpon* areas (Erin Gilmore, Clinton Corps office, personal communication). Before management strategies could be implemented, a wild fire burned the glade on April 7, 2000. The primary *Geocarpon* areas did not burn because the cover there is too sparse to carry a fire, but brushy and grassy areas at the edge of the glade did burn. Monitoring during the next few years will be interesting, as *Geocarpon* may

take advantage of newly cleared habitat. The population size in 2000 was independently estimated at 50 (Tim Smith, pers. comm.) to 80 individuals (pers. observations).

Like others before us (Palmer and Steyermark, 1950; Steyermark,1958; Steyermark et al., 1959; Rettig, 1983; Orzell and Bridges, 1987), we questioned why *Geocarpon* was not in similar habitat nearby. Subsequent searches by the authors of other sandstone exposures in St. Clair, Henry, Johnson, and Lafayette Counties have failed to reveal any additional populations of *Geocarpon*. However, in the spring of 2000, Tim Smith and others found a new population about ½ mi to the north of the Henry County population (Smith, 2001).

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HIGHLIGHTS OF MISSOURI FIELD BOTANY (1999–2000)

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This is the second in a series of articles intended to briefly describe important plant discoveries in Missouri. The first article appeared in *Missouriensis* Vol. 19 (Smith 1998) and covered the period of 1997–1998. As stated then, this brief listing is not intended to replace the reporting of new state record species or other significant discoveries that merit a more detailed account in this or other journals. I hope that these summaries of recent plant finds will be of interest to amateur and professional investigators and will inspire them to continued botanical exploration in Missouri. There are certainly important contributions yet to be made to our know-ledge of the state's flora.

NATIVE PLANTS

Continued surveys by Missouri Department of Conservation (MDC) biologists along with Paul McKenzie (U.S. Fish & Wildlife Service) and others in small areas of remnant sand prairie in Scott County resulted in the discovery in 1999 of new localities for the following species: *Aristida desmantha* Trin. & Rupr., *Carya pallida* (Ashe) Engl. & Graebn., *Cyperus grayoides* Mohlenbr., *Croton-opsis linearis* Michx., *Desmodium strictum* (Pursh) DC., *Poly-premum procumbens* L., and *Stylisma pickeringii* (Torr.) A. Gray *var. pattersonii* (Fernald & B.G. Schub.) Myint.

Aster furcatus Burgess, forked aster (Asteraceae).—In August 2000, Tim Smith and Brian Loges (both of MDC) relocated a healthy population of forked aster on a dolomite bluff along the Bourbeuse River in Franklin County. Steyermark had collected the species from the vicinity in 1941, but the location information was obscure. Loges later located three additional new sites farther downstream on the Bourbeuse. At three of the four sites, the aster was associated with *Sullivantia sullivantii.*

Campanula aparinoides Pursh, marsh bellflower (Campanulaceae).—Only the third extant population, and the first from northern Missouri, was located by Greg Gremaud (MDC) in 1999 in a seepy area near Goose Pond in Clark County.

Carex communis L. (Cyperaceae).—In April 2000, Amy Salveter and Paul McKenzie (USFWS), and Tim Smith revisited a mesic-forested slope in Roaring River State Park that was the only known extant Missouri site for the species, based on a previous collection. A healthy population was documented at the site and a new site was located at nearby Roaring River Conservation Area.

Carex sartwellii Dewey (Cyperaceae).—This sedge was discovered by Brad Jacobs (MDC) in June 1999 at a fen in Schuyler County. His find is only the third extant population known from the state, the others being in Holt and Nodaway counties.

Carex tetanica Schk. (Cyperaceae).—The fourth extant site for this sedge was located in 1999 at a fen in Meramec State Park by Paul McKenzie, Bill Summers, and Brad Jacobs. Jacobs found another population at a fen at Indian Trail Conservation Area, Dent County, in June 2000.

Crataegus spathulata Michx., littlehip hawthorn (Rosaceae). —In May 2000, Bill Summers discovered a small grove of this hawthorn at Tingler Lake Conservation Area, in Howell County. This small tree had last been documented from Missouri in Ozark County in 1937.

Cyperus flavicomus Michx. (Cyperaceae).—Paul McKenzie discovered a new site for this species in September 1999 in Chariton County at Swan Lake National Wildlife Refuge. It was previously known in Missouri from two Bootheel counties. One of only two extant populations in the state, this find constitutes a significant Missouri range extension.

Dryopteris cristata (L.) A. Gray, crested shield fern (Dryopteridaceae).—Greg Gremaud located this in 1999 at a Schuyler County fen. It is only the second Missouri site for the species.

Echinochloa walteri (Pursh) A. Heller, saltmarsh cockspur grass (Poaceae).—The third Missouri site and a new county record for this wetland grass was discovered by Paul McKenzie in September 1999 at Swan Lake National Wildlife Refuge, in Chariton County. This find significantly extends the species range in Missouri westward, because the other two sites were near the Mississippi River in St. Charles County.

Echinodorus tenellus (Mart.) Buch. var. *parvulus* (Engelm.) Fassett, dwarf burhead (Alismataceae).—This small plant was found at a mitigation site in Creve Coeur County Park, St. Louis County, by Doug Ladd (TNC). Although this species was collected St. Louis County in 1845 by George Engelmann, it had not been reported in this portion of the state since that time. This taxon is otherwise known from southernmost Missouri only in isolated populations in Howell and Scott counties.

Eleocharis wolfii A. Gray, Wolf's spike rush (Cyperaceae). —In June 1999, Paul McKenzie, Ken McCarty (DNR), and Brad Jacobs discovered the only known extant Missouri site for this spike rush at Otter Slough Conservation Area in Stoddard County. In late May 2000, Paul revisited the area and confirmed a second site. In June, he located five new sites in wet swales in prairies of the Osage Plains Natural Division and he was able to relocate it at a previously recorded site at Tucker Prairie, in Callaway County (McKenzie and Jacobs, 2000).

Filipendula rubra (Hill) B.L. Rob., queen-of-the-prairie (Rosa-ceae).—A new county record (Hickory County) in only the fifth Missouri county known to harbor this plant was discovered by Norman Murray (MDC) in July 2000. The fen where the species was found, on Muleshoe Conservation Area, also contains *Solidago riddellii*.

Fuirena simplex Vahl var. *aristulata* (Torr.) Kral, umbrella grass (Cyperaceae).—This dwarf variety of umbrella grass is primarily a Great Plains sedge but was known from two historical Missouri collections from the Missouri River floodplain. The variety was not recognized in Steyermark's *Flora of Missouri* (1963) but was included in Yatskievych (1999). Paul McKenzie and Brad Jacobs rediscovered it in 1999 in the Missouri River floodplain in Carroll County (McKenzie and Jacobs, 2000). Subsequent review of herbarium specimens turned up two additional collections from the same site from 1997 and 1998.

Geocarpon minimum Mack., geocarpon (Caryophyllaceae).—A new site for this federally-threatened plant was found in April 2000 by Tim Smith on a sandstone glade on U.S. Army Corps of Engineers land near Truman Lake, Henry County. It is the second known site for the species in Henry County (Raveill and Belsche, 2001), which is at the northernmost extent of the species' range.

Hypericum pyramidatum Dryander, great St. John's-wort (Clusiaceae).—Discovered in 1999 by Randy Knotts of Liberty Missouri, this only known extant Missouri site for the species, at Little Bean Marsh in Platte County, was confirmed by MDC botanists on a July 2000 visit. The only other recent Missouri observation of this species, by Don Kurz (MDC) in 1996 at Pawnee Prairie Conservation Area, was not relocated during a 1998 survey.

Lilium philadelphicum L. var. *andinum* (Nutt.) Ker Gawl., wood lily (Liliaceae).—Last known in Missouri from an 1878 collection in St. Louis, wood lily was rediscovered in June 2000 by Greg Gremaud and Mike Jones (both of MDC) at a privately-owned prairie in Sullivan County (Gremaud, 2001). The landowner had actually seen the plant and described it to Greg in 1991, but until this summer it had not been relocated and its identity confirmed.

Lilium superbum L., swamp lily or Turk's cap lily (Liliaceae). —This species was included by Yatskievych (1999) based on a single population in Perry County, but has been located at a second site in Missouri. While on a field trip with the Webster Groves Nature Study Society in May 2000, George Yatskievych discovered a small population along the edge of a slough at Sweetgum Public Access in Bollinger County. Plants at this site are suppressed and did not flower, presumably because of shading by adjacent trees.

Liparis loesellii (L.) Rich., Loesel's twayblade (Orchidaceae).—This orchid, typically found in Ozark fens and sinkhole ponds, was discovered in 1999 by Greg Gremaud in a seepy area near Goose Pond in Clark County. It is the first report of the species from northern Missouri.

Phaeoceros oreganus (Austin) Hässel de Ménendez, (Anthocerotaceae).—This new state record hornwort was collected by Bruce Allen (Missouri Botanical Garden) in June 2000 at White Ranch Conservation Area, in Howell County.

Polypremum procumbens L., juniper leaf (Buddlejaceae).— This plant is well-known from several sand prairies and other sandy sites in southeast Missouri. It was found in Ozark County in August 2000 by Paul McKenzie and Amy Salveter near the shore of Bull Shoals Lake. Tens of thousands of plants were seen, so it seems likely that the species may be found in the future at other sites around Bull Shoals Lake and possibly in other areas within the White River Region.

Rhynchosia difformis (Elliott) DC., double-formed snout bean (Fabaceae).—This bean was located in 1999 by Karen Kramer (MDC) and George Yatskievych at a Scott County sand prairie site. The species had not been documented from Missouri since 1900, when it was collected in Dunklin County.

Trifolium stoloniferum Muhl. ex Eaton, running buffalo clover (Fabaceae).—The third known population was located in 1999 by Ann Wakeman on an MDC public access site on the Gasconade River. Unfortunately there were only a few plants that were in poor condition. The plants could not be located during the 2000 growing season.

Urtica chamaedryoides Pursh, nettle (Urticaceae).—The fifth extant Missouri site and a new county record for this nettle was discovered by Paul McKenzie and Tim Smith in sandy soil at a Scott County cemetery in August 1999. Four of the five extant sites for the species have been discovered since 1992, indicating that more sites probably exist in southern Missouri.

INTRODUCED PLANTS

Chaenomeles speciosa (Sweet) Nakai, common flowering quince (Rosaceae).—This species frequently persists around old home sites. However, on a ridge near Morgan Spring in the Mark Twain National Forest in Oregon County, plants have naturalized to produce extensive thickets. Thus, the species can now be added to the register of the state's flora. This population was discovered in 2000 by George Yatskievych, Janeen Laatsch (MDC), and Bill Summers.

Oenanthe javanica (Blume) DC., water parsley (Apiaceae).—This species was noted in 2000 during herbarium research by George Yatskievych. Following communications with Jay Raveill (Central Missouri State University), the population along the shore of a small lake in Warrensburg (Johnson County) was found to be extant and reproducing. This Asian species, which is cultivated as an ornamental in water gardens, apparently has not been previously documented outside of cultivation in the United States (Yatskievych and Raveill, 2001).

Ottelia alismoides (L.) Pers., ottelia (Hydrocharitaceae).—This Afro-Asian aquatic plant was first recorded from Missouri when it was found in late July 2000 by Tom Johnson, Jeff Briggler,

and Mark Pelton (all of MDC) in a constructed shallow marsh at Big Cane Conservation Area in Butler County (Yatskievych and Raveill, 2001). The species is listed federally as a noxious weed although it is not yet clear if it poses a threat in southeast Missouri.

Pennisetum alopecuroides (L.) Spreng., Chinese fountain grass (Poaceae).—Doug Ladd found this non-native ornamental grass growing outside of cultivation in St. Louis County in August 2000. His is the first report of the species becoming naturalized in Missouri.

Sporobolus pyramidatus (Lam.) Hitchc., whorled dropseed (Poaceae).—This grass was relocated in Missouri by Brad Jacobs in 1998 for the first time since 1896. During 1999, Jacobs and Paul McKenzie documented it from roadsides in five additional counties (Jacobs and McKenzie, 2000). All of the extant occurrences are considered introductions, although the grasss probably was once native in western Missouri.

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REVISION OF THE GENUS *HEUCHERA* (SAXIFRAGACEAE) IN MISSOURI

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As circumscribed in the modern restricted sense (Morgan and Soltis, 1993; Soltis and Soltis, 1997), the vascular plant family Saxifragaceae includes about 30 genera and 550 total species of annual and perenial herbs. These are widely distributed in the Northern Hemisphere, mostly in temperate regions, with some genera extending to South America and from southern Asia to New Guinea. The western United States is considered a center of generic diversity for the family. In addition to natural populations in the United States, a number of genera contain species cultivated as ornamentals, including *Astilbe* (astilbe), *Heuchera* (alumroot), *Saxifraga* (saxifrage), and *Tiarella* (foamflower). In Missouri, once *Parnassia*, *Penthorum*, and the woody genera are removed to other families, the remaining four genera of Saxifragaceae sensu stricto are *Heuchera, Mitella, Saxifraga*, and *Sullivantia*.

Heuchera is endemic to North America and contains 35 to 55 species, depending upon how narrowly or broadly these are circumscribed. The first summary of *Heuchera* in North America was that of Torrey and Gray (1840), who treated only 15 species. Wheelock (1890) published the first critical assessment of the genus, including 21 species, but he knew many of these from relatively few specimens and was conservative by nature. Rydberg (1905) treated the group for the *Flora of North America* series and recognized 72 more narrowly defined species. Carl O. Rosendahl and his col-leagues published a series of papers on the genus beginning in 1905, notably the first detailed monograph of the genus (Rosendahl et al., 1930), and it is Rosendahl's species limits and infrageneric clas-sification that have been used as a starting point for subsequent taxonomic research on the genus.

Rosendahl et al. (1930) recognized 51 species and hybrids (although he subsequently described a few more) and divided the genus into 5 sections comprising 13 total subsections. Of these, the

species of eastern North America were divided among sect. *Euheuchera* (now referred to as sect. *Heuchera*) and sect. *Heruchea* Torr. & A. Gray. Of special interest for Missouri, Rosendahl (1951) later proposed a new species endemic to Missouri, describing *H. missouriensis* for a taxon formerly considered an intersectional hybrid between *H. puberula* and *H. americana*.

The most recent taxonomic revision to include the Missouri species was that of Wells (1984), who confined her biosystematic research to the taxa present in the eastern half of the United States and Canada. Wells questioned the legitimacy of parts of Rosendahl's complex infrageneric classification and also reduced to synonymy several of the taxa accepted by Rosendahl and his colleagues. She accepted only seven species and four additional varieties classified into a single section for *Heuchera* in eastern North America, in contrast to the 9 species and 13 varieties grouped into 2 sections that were accepted in Rosendahl's works.

The purpose of the present study was to reexamine the taxa of *Heuchera* attributed to Missouri by Rosendahl et al. (1930), Rosendahl (1951), and Wells (1984), based on the increased number of specimens available from the state since the time of those earlier studies. We evaluated the characters used by earlier authors to segregate taxa and compiled new keys and descriptions based only on Missouri materials. We examined about 420 specimens representing about 260 separate gatherings. Our thanks go to curators of the following institutions, which made specimens available for our study: Field Museum of Natural History (F), University of Kansas (KANU), University of Minnesota (MIN), Missouri Botanical Garden (MO), Southeast Missouri State University (SEMO), Southwest Missouri State (SMS), Truman State University (NEMO), and the University of Missouri–Columbia (UMO).

TAXONOMIC TREATMENT

Heuchera L.

Plants with short, stout rhizomes. Leaves all basal (rarely 1 or a few highly reduced bracteal leaves alternate on the inflorescence stalks), short- to more commonly long-petiolate. Stipules scalelike, inconspicuous, fused to the petiole base to above the midpoint, the margins fringed, persistent on the rhizome after the leaves die back. Leaf blades mostly about as long as wide, circular to broadly ovate

or kidney-shaped, the base cordate, the tip rounded or narrowed to a blunt or sharp point, the margins with 3–7 shallow lobes, also finely to coarsely crenate or serrate and ciliate, palmately-veined with usually 7 primary veins, adaxially glabrous to hairy and/or glandular, green, sometimes with lighter mottling, abaxially glabrous to hairy and/or glandular, usually grayish green or reddish purple-tinged. Inflorescences panicles with usually numerous flowers, usually long-pedunculate, glabrous or more commonly hairy and/or glandular, with small scalelike or leaflike bracts at the branch points. Flowers somewhat zygomorphic or appearing actinomorphic, each subtended by a small, linear bract at the base of the flower stalk. Hypanthium obconic to bell-shaped, fused to half or more the length of the ovary. Sepals oblong to triangular-oblong, rounded at the often green-spotted tips. Petals glabrous to minutely hairy, the margins entire or finely toothed, green, white, or pink. Stamens 5, barely included to long-exserted from the calyx, the anthers small, versatile, white, pink, or orange. Ovary 1-locular, the placentation parietal. Styles tapered, persistent at fruiting, the stigma more or less capitate. Fruits capsules, ovoid, 2-beaked, dehiscing longitudinally from between the beaks. Seeds numerous, variously shaped, usually somewhat asymmetrical in outline, smooth or with finely tuberculate or echinate, dark brown to nearly black.

Comprising 35–55 species, widely distributed in North America. Type species: *H. americana* L.

KEY TO HEUCHERA SPECIES IN MISSOURI

1. Hypanthium and calyx 3–12 mm long at flowering, 2.5–7.5 mm in diameter, the free portion above the ovary 0.6–7.0 mm long, the outer surface with minute glandular hairs, green to yellowish green; petals elliptic-spatulate, shorter than to slightly longer than the sepals
    2. Hypanthium at flowering with the free portion 0.6–2.0 mm long, weakly asymmetrical .... 1. *H. americana*
    2. Hypanthium at flowering with the free portion 2–7 mm long, strongly asymmetrical ..... 3. *H. richardsonii*
1. Hypanthium and calyx 1.3–3.3 mm long at flowering, 1.1–2.9 mm in diameter, the free portion above the ovary 0.1–0.4 mm long, the outer surface with shaggy glandular hairs, white to

pink, the sepals often green-tipped; petals linear or oblanceolate, 2–3 times as long as the sepals

3. Leaf blades with the lobes rounded; petals oblanceolate; pubescence of the petioles and main inflorescence axis of longer, straight, spreading hairs and/or minute glandular hairs; seeds smooth .....2. *H. parviflora*
3. Leaf blades with the lobes widely to narrowly triangular, narrowed to pointed tips; petals linear; pubescence of the petioles and main inflorescence axis of woolly hairs; seeds spiny ..... 4. *H. villosa*

1. Heuchera americana L. (common alum root)

Petioles glabrous to densely pubescent with relatively long spreading hairs having minute glandular tips, often also with moderate to dense minute glandular hairs. Leaf blades (0.5–) 2.0–11.0 cm long, circular to broadly ovate, the upper surface glabrous or sparsely hairy, the undersurface glabrous or sparsely to moderately hairy, the lobes more or less rounded, the margins scalloped or toothed. Inflorescences 25–75 cm long, erect or ascending, the axes glabrous or sparsely to densely hairy with mostly spreading hairs to 3 mm long having minute glandular tips, usually also with scattered minute glandular hairs, especially on the branches and toward the inflorescence tip. Hypanthium at flowering 2–6 mm long, 2–4 mm in diameter, the free portion 0.6–2.0 mm long, weakly zygomorphic (often appearing more zygomorphic upon pressing), urn-shaped to bell-shaped when fresh, glabrous or minutely glandular on the outer surface, green to yellowish green, sometimes reddish-tinged. Sepals 1–3 mm long, glabrous or minutely glandular on the outer surface and margins, the sinuses between the sepals relatively narrow. Petals 1–4 mm long, oblanceolate to narrowly spatulate, glabrous or minutely glandular on the outer surface and margins, green or white, sometimes pinkish-tinged. Fruits with the body 4–10 mm long, tapered into the 3.0–4.5 mm long styles. Seeds 0.6–0.9 mm long, ovoid, the surface with fine tubercles or spines, dark brown. $2n$=14. Flowering April to June.

Scattered in the southern half of the state, northward locally to Lewis County in counties along the Mississippi River (Map 1a, b) (eastern U.S. and adjacent Canada west to Nebraska and Oklahoma). Bases and ledges of bluffs and rock outcrops, rocky

banks of streams, mesic to dry upland forests, and edges of glades; also roadsides, roadcuts, and railroads.

Wells (1984) treated *H. americana* as comprising a complex of three varieties, only two of which have been found in Missouri. Her var. *hispida* (Pursh) E.F. Wells is restricted to the mountains of Virginia and adjacent states and is characterized by more or less glabrous petioles, hypanthia with the free portion 1.5–2.0 mm long, and petals wider than the sepals.

KEY TO VARIETIES OF *H. AMERICANA*

1. Petioles glabrous or sparsely hairy, sometimes also glandular; hypanthium with the free portion 0.6–1.5 mm long ..... 1a. var. *americana*
1. Petioles moderately to densely hairy, also glandular; hypanthium with the free portion 1.5–2.0 mm long ..... 1b. var. *hirsuticaulis*

1a. Heuchera americana var. americana

Petioles glabrous or sparsely hairy, the hairs mostly less than 1 mm long, sometimes also glandular. Hypanthium urn-shaped at flowering, the free portion 0.6–1.5 mm long. Petals narrower than the sepals. $2n$=14.

Possibly introduced, known only from McDonald, Newton, and St. Louis Counties (Map 1a) (eastern U.S. and adjacent Canada west to Illinois, Oklahoma, and Louisiana). Bluffs; also railroads.

Wells (1984) reported the distribution of var. *americana* as including a number of counties in northwestern Arkansas, but cited only a single McDonald County specimen from Missouri (the first report for the state). Of the three specimens representing var. *americana* located during our research, the historical collection from a railroad embankment in McDonald county (cited by Wells [1984]) presumably is a non-native occurrence, but the more recent specimen from a bluff along a creek in Newton County may in fact represent a native population. The St. Louis County specimen collected by Sherff contains no further locality data and may represent a gathering from plants cultivated in a garden. Steyermark (1963) discussed the problems of interpreting Sherff's collections, many of which apparently were made from plants cultivated in

gardens, and the inclusion of this record in the distribution of the variety is equivocal.

SPECIMENS EXAMINED.—**McDonald Co.:** railroad banks in Noel, 7 Oct 1931, *J.H. Kellogg s.n.* (MO). **Newton Co.:** Camp Crowder, bluff along creek on W road, 3 June 1997, *K. Mlekush 1020* (SMS). **St. Louis Co.:** without further locality, 2 July 1910, *E.E. Sherff 187* (F).

1b. Heuchera americana var. hirsuticaulis (Wheelock) C. Rosend., Butters & Lakela

H. hispida Pursh var. *hirsuticaulis* Wheelock

(Type collection from south of St. Louis)

H. hirsuticaulis (Wheelock) Rydb. in Britton

H. americana var. *interior* C. Rosend., Butters & Lakela

Petioles moderately to densely hairy, the hairs to 3 mm long, also glandular. Hypanthium urn-shaped to bell-shaped at flowering, the free portion 1.5–2.0 mm long. Petals narrower than the sepals.

Scattered in the southern half of the state, northward locally along the Mississippi River (Map 1b) (Ohio to Nebraska south to Arkansas and Oklahoma). Bases and ledges of bluffs and rock outcrops, rocky banks of streams, mesic to dry upland forests, and edges of glades; also roadsides, roadcuts, and railroads.

The classification of this taxon remains controversial. Some authors have treated it as a stabilized hybrid swarm (*H. xhirsuticaulis*) originally derived through repeated hybridization between the more eastern *H. americana* and the more western *H. richardsonii* (Gleason and Cronquist, 1991). Wells (1984) included it within her concept of *H. americana*, but discussed the possibility that some of its features might have resulted from past introgression between *H. americana* (var. *americana*) and *H. richardsonii*. She demonstrated that these species can hybridize easily and that artificial crosses between them (as well as backcrosses to either parent) give rise to fertile progeny (Wells, 1979), but suggested that differences in habitats and cold tolerance keep the taxa spacially and reproductively isolated throughout most of their ranges. The zone of geographic overlap between *H. americana* var. *americana* and *H. richardsonii* coincides almost entirely with that stated for *H. americana* var. *hirsuticaulis* above. Nevertheless, Wells (1984) was able to show a relatively sharp discontinuity between populations of *H. americana* and *H. richardsonii* in this region for every character

separating the two species, with only occasional intermediates, and the populations of var. *hirsuticaulis* fell within the morphological variation that she ascribed to *H. americana*. As Missouri specimens are relatively uniform morphologically and nearly all are separated easily from *H. richardsonii* by the characters in the key, the present treatment follows that of Wells (1984) in accepting var. *hisuticaulis* as a component of *H. americana*. More biosystematic research into this problem will be necessary to resolve the classification of this complex.

REPRESENTATIVE SPECIMENS.—**Audrain Co.**: along Salt River, 1 mi E of Molino, ledges of limestone bluffs with cherty and clay slopes above, 14 May 1939, *J.A. Steyermark 22450* (F). **Barry Co.**: Eagle Rock, on bluffs, 5 June 1897, *B.F. Bush 106* (MO). **Bollinger Co.**: Blue Pond Natural Area, partially wooded slope above a tributary to Pond Creek which flows into the Castor River, 31 May 1979, *R. Haefner, R. 528* (UMO). **Boone Co.**: Columbia, 1 mi S of University of Missouri, Hinkson Creek drainage, woodland slopes and ravines, 28 May 1958, *D.B. Dunn 12762* (UMO). **Butler Co.**: Poplar Bluff, rocky hillsides, 4 April 1919, *E.J. Palmer 14696* (MO). **Camden Co.**: Ha Ha Tonka State Park, Red Sink, 24 April 1995, *B.J. Farnsworth B438* (SMS). **Cape Girardeau Co.**: Trail of Tears State Park, by old campground area, in woods, 4 May 1975, *K. Christian 270* (SEMO). **Carter Co.**: just N of Big Springs State Park, rocky oak-hickory slope, 28 May 1960, *P.L. Redfearn Jr. 5736* (SMS). **Crawford Co.**: Huzzah Wildlife Refuge, NE of confluence of Huzzah Creek and Courtois Creek (Reis Biological Station), ,13 May 1989, *M.L. Conrad and class 12141* (NEMO). **Dade Co.**: 5 mi SW of Everton, steep rocky wooded slope, 13 May 1952, *E.J. Palmer 53767* (UMO). **Dallas Co.**: 11 km N of Bennett Springs, Osborn Bluff, lower slope. rock outcrop area, 8 Oct 1974, *J. Conrad 3501* (MO). **Dent Co.**: without further locality, 20 May 1928, *J.H. Kellogg 1769* (MO). **Douglas Co.**: Between Roosevelt and Richville, limestone slopes along bluffs of North Fork of White River, 1 June 1935, *J.A. Steyermark 19174* (MO). **Dunklin Co.**: Riverside, 9 May 1908, *W.W. Ohlweiler s.n.* (MO). **Franklin Co.**: Meramec State Park, bluffs, common, 31 May 1938, *J.M. Mason s.n.* (UMO). **Greene Co.**: South of Lake Springfield, glade, 13 May 1975, *P.W. Nelson 608* (SMS). **Howard Co.**: without further locality, 23 Apr 1893, *H. Eggert s.n.* (MO). **Howell Co.**: Tingler Lake Conservation Area, ca. 7 mi S of West Plains on South Fork of Spring River, spring-fed meadow/prairie, 23 May 1997, *B. Summers & C. Dodds 8126* (MO). **Iron Co.**: The "Shut-ins", Arcadia, riverbank, 25 May 1918, *J.R. Churchill s.n.* (MO). **Jasper Co.**: Webb City, dry ground, 7 Apr 1907, *E.J. Palmer 1108* (MO). **Jefferson Co.**: ca. .5 mi S of the intersection of Rice Road and Marble Spring Road, NW of Pevely, in rock crack at margin of glade and deep gully, 10 June 1973, *G. Davidse 3394*

(MO). **Laclede Co.**: along Gasconade River, near Hazel Green, rocky limestone bluffs, 3 May 1934, *J.A. Steyermark 8327* (MO). **Lawrence Co.**: 1.5 mi SW of Verona, rocky wooded hillside along small stream, 10 May 1951, *E.J. Palmer 51806* (SMS, UMO). **Lewis Co.**: Near Canton, cliffs along creek, 6 July 1932, *J.H. Kellogg 26005* (MO, UMO). **Madison Co.**: Cherokee Pass Quadrangle. W-facing slopes, open and shaded areas on margin of rhyolite glade, ca. 0.25 mi E of Peters Creek 4 June 1996, *A.E. Brant 3610* (MO). **McDonald Co.**: without further locality, 24 July 1893, *B.F. Bush s.n.* (MO). **Monroe Co.**: Salt River Basin, NE facing slope of Henderson Lake, fairly rocky, soil with much clay, loosely packed, 14 July 1973, *B. Hinterthuer 543* (MO). **Newton Co.**: 0.5 mi E of Missouri-Kansas State Line, along partially shaded limestone ledge along high S-facing bluff of Shoal Creek, 20 May 1953, E.J. *Palmer 55595* (UMO). **Oregon Co.**: Irish Wilderness, W of Turner's Mill Spring, shaded cleft and ledges along bluffs of Eleven Point River, 14 July 1933, *E.J. Palmer & J.A. Steyermark 41758* (MO). **Osage Co.**: 4 mi N of Meta, N-facing wooded limestone bluffs along Osage River, 4 June 1938, *J.A. Steyermark 5830* (MO). **Ozark Co.**: Near Pontiac, rocky wooded river bluffs, 27 June 1928, *E.J. Palmer 34801a* (MO). **Perry Co.**: along Mississippi River between Lembach Landing and Cape Cinque Hommes, 2–3½ mi E of Starland, upper acid slopes on top of bluffs, 21 Apr 1938, *J.A. Steyermark 4945* (F, MO). **Phelps Co.**: near Arlington,, shaded clefts, along cliffs, 9 July 1933, *E.J. Palmer & J.A. Steyermark 41408* (MO). **Pike Co.**: Along Peno Creek, .5–.75 mi SE of Frankford, in crevices of SE-facing limestone bluffs, 15 Aug 1952, *J.A. Steyermark 74329* (F). **Pulaski Co.**: Fort Leonard Wood Army Base, Falls Hollow Sandstone Glade, rim of sandstone canyon along edge of glade, 13 May 1994, *J. Hays, 430* (MO). **Ralls Co.**: Hannibal, on bluffs at NE side of Riverside Cemetery, 4 June 1972, *W.G. D'Arcy 5947* (MO). **Reynolds Co.**: Shut-in of Black River, near Monterey, 6 June 1930, *H.W. Rickett s.n.* (UMO). **Ripley Co.**: Bay Mills, rocky bluffs of Current River, 24 July 1897, *K.K. Mackenzie 403* (MO). 1 mi N of Scott City, on limestone outcrop, 2 May 1979, *M. Castelli 290* (SEMO). **St. Charles Co.**: 3.5 mi E of Augusta on State highway 94, edge of Missouri River flood plain, sandstone outcrop, 29 May 1978, *J.C. Solomon 3823* (MO). **St. Louis Co.**: Bean Shooter Gulch, Lawler Ford Road, 2.5 mi S of Ellisvile, 17 May 1936, *F.A. Barkley 33* (MO). **Ste. Genevieve Co.**: Pickle Springs, 6 mi E of Farmington off Highway 32 on Co. Highway AA, growing in glade along main path, 19 May 1970, *L.M. Carbol 17* (MO). **Shannon Co.**: near Alley Spring, terrace along internittent waterway, 17 June 1997, *C. Becker 67* (UMO). **Stoddard Co.**: Brown Sand and Gravel Company tract, 2 mi NE of Dexter, wooded ridge, 26 Apr 1989, *B. Summers 2862* (MO). **Stone Co.**: 4 mi N of Blue Eye Cow Creek Recreation Area, E of camping area, scattered on rocky, wooded hillside, 23 May 1979, *R. Brooks & R.L. McGregor 14177* (KANU). **Taney Co.**: Swan, common along bluffs, 4 June 1898, *B.F. Bush 195* (MO). **Warren Co.**: Daniel Boone State Forest, ca. 8 mi SW of Jonesburg, ca. 100 ft W of maintenance garage, fire tower road, several plants growing in old roadbed, forested area, 16 June 1993, *C.E. Darigo & D.V. Darigo 1378* (MO). **Washington Co.**: Near Mineral Point, woods, 29 May 1892, *H.*

Eggert s.n. (MO). **Wayne Co.:** Along Black River, 3.5 mi SW of Piedmont, crevices of limestone bluffs, 28 Apr 1939, *J.A. Steyermark 21918* (F). **Wright Co.:** 1.5 mi S of Cedar Gap, edge of oak woods, 22 May 22–3 June 1911, *O.E. Lansing Jr. 3002* (F).

2. Heuchera parviflora Bartling (small-flowered alum root)

Petioles sparsely to densely pubescent with minute glandular hairs, sometimes also with sparse to dense longer spreading hairs having minute glandular tips. Leaf blades 2–13 cm long, circular to kidney-shaped, the surfaces glabrous or sparsely to moderately hairy and sometimes also minutely glandular-hairy, the lobes more or less rounded, the margins scalloped or toothed. Inflorescences 9–45 cm long, ascending to pendant or spreading, the axes sparsely to densely pubescent with minute glandular hairs, sometimes also with sparse to dense longer spreading hairs having minute glandular tips. Hypanthium at flowering 1.3–3.5 mm long, 1–2 mm in diameter, the free portion 0.1–0.3 mm long, appearing actinomorphic or very slightly zygomorphic (sometimes appearing more zygomorphic upon pressing), obconic to somewhat bell-shaped when fresh, glabrous or minutely glandular on the outer surface, green to yellowish green, rarely reddish-tinged. Sepals 0.5–1.5 mm long, glabrous or minutely glandular on the outer surface and margins, the sinuses between the sepals relatively narrow. Petals 1.5–3.5 mm long, oblanceolate, glabrous, white, rarely pinkish-tinged. Fruits with the body 2.8–5.5 mm long, tapered into the 1.5–4.0 mm long styles. Seeds 0.4–0.6 mm long, ellipsoid-ovoid, the surface smooth, dark brown. $2n$=14. Flowering July to November.

Scattered in the Ozark Division (Map 2a, b) (southeastern U.S. west to Missouri and Mississippi). Bluffs and rock outcrops, mostly on limestone or dolomite substrates.

Wells (1984) recognized two varieties of *H. parviflora*, both present in Missouri and differing in trichome characteristics. Occasional nearly glabrous plants, which Steyermark (1963) called *H. puberula* f. *glabrata*, are essentially examples of var. *puberula* with the minute glandular trichomes mostly absent except on the inflorescence branches and flowers. These unusual individuals are not easily accomodated by the key to varieties.

KEY TO VARIETIES OF *H. PARVIFLORA*

1. Petioles and inflorescence axis sparsely to moderately pubescent with longer hairs, the minute glandular hairs sparse or absent except on the inflorescence branches .....2a. var. *parviflora*
1. Petioles and inflorescence axis densely pubescent only with minute glandular hairs..... 2b. var. *puberula*

2a. Heuchera parviflora var. parviflora

H. parviflora var. *rugelii* (Shuttlew. ex Kunze) C. Rosend., Butters & Lakela
H. rugelii Shuttlew. ex Kunze
H. missouriensis C. Rosend.
(Type collection from Wayne County)

Petioles sparsely to moderately pubescent with gland-tipped hairs 0.7–2.5 mm long. Leaf blades with the upper surface glabrous or sparsely pubescent with shorter nonglandular hairs, the undersurface sparsely to moderately pubescent with longer gland-tipped hairs. Inforescences with the main axis sparsely to moderately pubescent with gland-tipped hairs 0.7–2.5 mm long, these grading into minute glandular hairs on the ultimate branches, the small bracts at the branch points scalelike or leaflike, with toothed margins. $2n$=14.

Scattered in the Ozark Division (Map 2a) (southeastern U.S. west to Missouri and Arkansas). Bluffs and rock outcrops, mostly on limestone or dolomite substrates, less commonly on sandstone.

Based on materials sent to him by Julian Steyermark, Rosendahl (1951) described *H. missouriensis* as a rare species endemic to limestone bluffs in Madison and Wayne Counties, Missouri. He contrasted this from his *H. parviflora* var. *puberula* (also now considered a synonym of var. *parviflora*) by its denser hairiness, slightly narrower inflorescences, more numerous flowers with shorter stalks, and less round-based, slightly shorter fruits. Steyermark (1963) accepted *H. missouriensis* and separated it from *H. puberula* (now treated as *H. parviflora* var. *puberula*) on the basis of whether the hairs of the hypanthium and sepals were gland-tipped or not. Since that time, many more specimens have accumulated in herbaria. It is apparent that Steyermark's observations on hypanthium pubescence were spurious, as all members of the *H. parviflora* complex have similar, short, gland-tipped hairs.

Also, the characters used by Rosendahl to characterize *H. missouriensis* are all expressed singly or together in plants of other parts of the range of the complex and are part of the continuum of morphological variation in *H. parviflora*.

REPRESENTATIVE SPECIMENS.—**Howell Co.**: 6 mi SW of Willow Springs, low moist ledges of dolomite bluffs on Noblett Creek, 31 Aug 1990, *B. Summers 3696* (MO). **Madison Co.**: along St. Francis River between mouth of Captain Creek, Fars and Jewett, crevices of limestone bluffs, 15 Nov 1936, *J.A. Steyermark 20980* (MO). **Ozark Co.**: near Tecumseh, moist, shaded ledges, along dolomite bluffs of river, 7 Oct 1927, *E.J. Palmer 32908* (MO, UMO). **Shannon Co.**: without further locality, 18 July 1891, *B.F. Bush s.n.* (UMO). Texas Co.: 4 mi E of Success, N-facing sandstone ledges of deep gorge, 23 Sep 1992, *B. Summers 5568* (MO). **Wayne Co.**: Hall's Bluff, on Wappapello Lake, ca. 6 mi S of Greenville, bluff face, 15–20 feet above present water stage, 27 July 1994, *S. Hudson 494* (MO).

2b. var. puberula (Mack. & Bush) E.F. Wells

H. puberula Mack. & Bush (Type collection from Shannon County)

H. puberula f. *glabrata* Steyerm. (Type collection from Shannon County)

Petioles densely pubescent with minute (less than 0.6 mm long) glandular hairs, rarely glabrous or nearly so. Leaf blades with the surfaces moderately to densely pubescent with minute glandular hairs, rarely glabrous or nearly so. Inforescences with the main axis moderately to densely pubescent with minute (less than 0.6 mm long) glandular hairs, the small bracts at the branch points scalelike, with entire margins. $2n$=14.

Scattered in the Ozark Division (Map 2b) (Indiana to Tennessee west to Missouri and Arkansas). Bluffs, apparently restricted to limestone or dolomite substrates.

REPRESENTATIVE SPECIMENS.—**Barry Co.**: along White River, between Shreiner Ferry and Shell Knob, S of town of Shell Knob, shaded crevices of limestone bluffs, 24 Aug 1935, *J.A. Steyermark. 19576* (MO). **Carter Co.**: near Van Buren, limestone bluffs of Current River, 10 Oct 1920, *E.J. Palmer 19448* (MO,UMO). **Douglas Co.**: Little Indian Creek, ca. 1 mi E of County Highway E and less than 1 mi W of Howell County line, common locally under large S-facing dolomite overhang, 2 Oct 1989, *G. & K. Yatskievych & T. Smith 89-391* (MO). **Howell Co.**: 4.5 mi W of Willow Springs, on Indian Creek, moist portions of N-facing limestone bluffs, 24 May 1979, *B. Summers 460* (MO). **Oregon Co.**: Turner Mill Spring, moist sandy ledges, dolomite bluffs, 14 July 1933, *E.J. Palmer & J.A. Steyermark*

41726 (MO). **Ozark Co.**: near Tecumseh, moist shaded ledges along bluffs of river, 7 Oct 1927, *E.J. Palmer 32908* (MO). **Pulaski Co.**: along Gasconade River. W of Portuguese Point. 6–7 mi (by air) SSW of Dixon, NW- and N-facing wooded limestone bluff with chert above, 10 Sep 1956, *J.A. Steyermark 82536* (UMO). **Ripley Co.**: 2 mi N of mouth of Buffalo Creek, about 5 mi E of Bennett, limestone bluffs along spring branch tributary to Current River, 6 Aug 1934, *J.A. Steyermark 14269* (MO,UMO). **Shannon Co.**: at Jam-up Bluff along Jack's Fork of Current River, 4 mi N of Teresita and 6 mi NW of Montier, N-facing base of limestone bluffs, 2 Oct 1948, *J.A. Steyermark 66615* (F). **Stone Co.**: along Horseshoe Bend of White River, on W and S side of river. vicinity of Cedar Hollow. 3¼–3½ mi (by air) E of Viola, common in crevices of bluffs in middle part, 14 July 1956, *J.A. Steyermark 81955* (UMO). **Taney Co.**: 1 mi E of Forsyth, along White River, limestone bluffs, 28 June 1937, *J.A. Steyermark 22764* (F). **Texas Co.**: 4 mi SE of Arroll, along Jacks Fork of Current River, limestone bluffs, 15 Aug 1934, *J.A. Steyermark 14579* (F, MO, UMO).

3. Heuchera richardsonii R. Br. (prairie alum root)

H. richardsonii var. *affinis* C. Rosend., Butters & Lakela

H. richardsonii var. *grayana* C. Rosend., Butters & Lakela

Petioles usually densely pubescent with relatively long spreading hairs having minute glandular tips, usually also with moderate to dense minute glandular hairs. Leaf blades 1.5–9.5 cm long, circular to broadly ovate, the upper surface glabrous or sparsely hairy, the undersurface sparsely to densely hairy, the lobes more or less rounded, the margins scalloped or toothed. Inflorescences 25–100 cm long, erect or ascending, the axes glabrous or sparsely to densely hairy with mostly spreading hairs to 5 mm long having minute glandular tips, also with scattered minute glandular hairs, especially on the branches and toward the inflorescence tip. Hypanthium at flowering 5–11 mm long, 4–8 mm in diameter, the free portion 2–7 mm long, conspicuously zygomorphic, broadly bell-shaped when fresh, minutely glandular on the outer surface, green to yellowish green, sometimes reddish-tinged. Sepals 1.5–4.0 mm long, minutely glandular on the outer surface and margins, the sinuses between the sepals relatively broad. Petals 1.5–4.0 mm long, oblanceolate to narrowly spatulate, usually minutely glandular on the outer surface and margins, green or white, sometimes pinkish-tinged. Fruits with the body 7.0–14.5 mm long, tapered into the 3.0–4.5 mm long styles. Seeds 0.6–0.9 mm long, ovoid, the surface with fine tubercles or spines, dark brown. $2n$=14, 28. Flowering April to June.

Scattered nearly throughout the state, most abundant in the Glaciated Plains and Unglaciated Plains Divisions, apparently absent from the Mississippi Lowlands (Map 3) (Michigan to Montana south to Indiana, Oklahoma, and Colorado; Canada). Upland prairies, glades, ledges and tops of bluffs, and rock outcrops in mesic to dry upland forests; also roadsides and railroads.

REPRESENTATIVE SPECIMENS.—**Adair Co.**: 4.6 mi S50.W of Kirksville, on NE-facing slope transition from prairie to deciduous oak-hickory woods, 12 May 1970, *M.L. Conrad 5578* (MO, NEMO). **Barry Co.**: above Table Rock Lake, ca. 1 mi S of Eagle Rock, S-facing limestone bluffs & rocky/wooded slopes, 3 May 1969, *P.L. Redfearn, Jr. 26006* (SMS). **Barton Co.**: 1 mi E of Milford, sandstone ledges along small stream, upland woods, 29 Apr 1951, *E.J. Palmer 51681* (UMO). **Boone Co.**: 10 mi NE of Columbia at sandstone bluff area, 1 June 1969, *B.J. Cox 1113* (SMS, UMO). **Butler Co.**: Missouri Army National Guard Training Site, on edge of poorly maintained road leading to sites 7 and 8 just N of intersction with main road through complex, primarily dry upland, oak-hickory woods, several low-lying sites along seasonal streams, 8 May 1998, *A. Bornstein, 615* (SEMO). **Callaway Co.**: Tucker Prairie, Kucera Research Station (NW¼ of prairie), prairie, 21 May 1999, *B. Tadych. BT99-24* (UMO). **Camden Co.**: 2 air mi NW of Hurricane Deck, above Lake of the Ozarks along Lake Road 5-58, scattered in shade on upper part of high NW-facing limestone cliff, 10 May 1990, *R.E. Brooks & Z. Wang* 19728 (KANU). **Carroll Co.**: Bunch Hollow Wildlife Area, N of Coloma, open wooded slope, 22 May 1989, *B. Summers 2890* (MO). **Cedar Co.**: along E Fork of Sac River, 6½ mi SW of Bear Creek P.O., SW-facing limestone bluffs with chert above, along E Fork of Sac River, wooded slopes, 1 May 1951, *J.A. Steyermark 71412* (UMO). **Clark Co.**: slopes along Des Moines River, ½–1½ mi NE of Athens, NE-facing slopes, 30 May 1941, *J.A. Steyermark 28683* (F). **Clinton Co.**: Converse, dry banks, 12 July 1930, *B.F. Bush 11856* (MO). **Cole Co.**: along Osage River, 1½–2 mi E of Henley, S-facing bluffs, moist sandy crevices at base, 7 May 1951, *J.A. Steyermark 71171* (F). **Dade Co.**: 5 mi E of Greenfield, rocky wooded hillside along ravine, 11 May 1949, *E.J. Palmer 49031* (UMO). **Dallas Co.**: Old Baldy Bluff, 5.5 km N of Bennett Springs, bald prairie, thin dolomite soils on upper slope, 20 May 1975, *J. Conrad 3615* (MO). **Dent Co.**: originated from Rhyse. cultivated in greenhouse at Missouri Botanical Garden, without date, *J.H. Kellogg s.n.* (MO). **Franklin Co.**: 3 mi NW of Argo, sandstone bluffs along Little Bourbeuse River, 30 Aug 1936, *J.A. Steyermark 20000* (MO). **Gasconade Co.**: along Missouri River, 2½ mi NE of Gasconade, crevices of sandstone bluffs at base of ravine slope along river, 4 July 1939, *J.A. Steyermark 27841* (F). **Greene Co.**: Springfield, S of railroad and 100 E of highway passing E of powerplant, open, rocky woods, 13 May 1972, *M.D. Brockman 213* (SMS). **Grundy Co.**: without further locality, 6 June 1937,

D.R. Crookshanks 215 (UMO). **Hickory Co.**: ca. 2mi SW Pomme de Terre State Park, upland rocky woods, open rocky soil, 8 May 1983, *P.L. Redfearn, Jr. 33273* (SMS). **Howard Co.**: near Rocheport, limestone bluff above railroad tunnel, 18 May 1935, *H.W. Rickett 738* (UMO). **Iron Co.**: 2 mi S of Peoria, crevices of porphyritic outcrops on top of Johnson Mountain, 18 Aug 1936, *J.A. Steyermark 21001* (MO). **Jasper Co.**: near Carl Junction, rocky hillside, 8 May 1920, *E.J. Palmer 17420* (UMO). **Jefferson Co.**: about 7 mi SE of Pacific, in woods, in dry sandy soil derived from St. Peter sandstone, 15 May 1927, *J.A. Steyermark 837* (MO). **Johnson Co.**: along South Fork of Blackwater River, 3.5 mi N of Holden, on lime rocks next to creek, 18 May 1949, *J.A. Steyermark 67867* (F). **Laclede Co.**: along Osage Fork of Gasconade River, near Davis Spring, 3 mi N of Pease Spring, lime bluff crevices near the base, 17 May 1936, *J.A. Steyermark 10569* (MO). **Lafayette Co.**: 4 mi NE of Odessa, sterile soil openings on oak-hickory slopes, 17 May 1949, *J.A. Steyermark 67802* (F). **Lawrence Co.**: near Chesapeake, steep rocky wooded hillside, 8 July 1950, *E.J. Palmer 50389* (UMO). **Lincoln Co.**: W of Foley, open places, thin sandy soil on upland wooded slopes near head of ravine of Sandy Creek, 25 May 1933, *J.A. Steyermark 8407* (MO). **Macon Co.**: Ethel, dry prairies, 11 June 1915, *B.F. Bush 7599* (MO). **Marion Co.**: N side of Hannibal, base of bluffs, frequent, flowers green, 26 May 1984, *W.G. & N.S. D'Arcy 15494* (MO, UMO). **McDonald Co.**: along Indian Creek, 2½–3 mi SE of Goodman, in crevices of N-facing bluffs along creek, 26 Sep 1947, *J.A. Steyermark 65207* (F). **Monroe Co.**: along South Fork of Salt River, 1 mi N of Victor, ravine slopes above lime bluffs, 31 May 1936, *J.A. Steyermark 10939* (MO). **Montgomery Co.**: Mineola Hill, rock ledges in valley W of road, 12 May 1935, *H.W. Rickett 696* (UMO). **Morgan Co.**: along Highway 5, 2 mi N of Versailles, natural prairie, 23 May 1936, *J.A. Steyermark 10600* (MO). **Nodaway Co.**: near Maryville, prairies, 13 June 1924, *E.J. Palmer 25438* (MO). **Osage Co.**: along Osage River, 4 mi N of Meta, N-facing wooded limestone bluffs, 4 June 1938, *J.A. Steyermark 5830* (F). **Ozark Co.**: E-facing bluff of North Fork of White River, ca. 4 mi SE of Dora, on wooded slope, 17 May 1964, *D.M. Eggers 980* (SMS). **Pettis Co.**: Goodnight-Henry Prairie, property of The Nature Conservancy, along W edge, prairie, 1 May 1991, *M. Skinner 2255* (SMS). **Phelps Co.**: between Burlington Northern Railroad and route KK, ca. 3 mi E of St. James, prairie remnant, 24 May 1990, *M.L. Conrad 12519* (MO, NEMO). **Pike Co.**: Vandalia Lake Glade, just S of the picnic shelter on the NW shore of Vandalia Community Lake, limestone glade, 29 May 1993, *B.S. Edmond 94* (UMO). **Polk Co.**: Camp Fire Girls Camp at Graydon Springs, ca. 2 mi SE of Eudora, niche of sandstone bluff, 1 May 1963, *D.M. Eggers & L. Blinn 475* (SMS). **Ralls Co.**: Salt River Basin, SE of Cannon Dam by Highway EE, public access, rare in open oak woods on rocky limestone soil of steep NW slope, 13 June 1974, *J. Hudson 396* (MO, UMO). **Randolph Co.**: tributary to Little Perche Creek, near Howard County line, 7 mi SW of Clark, upland, dissected, acid woods, 21 May 1956, *J.A. Steyermark 81292* (UMO). **St. Charles Co.**: along Old Colony Road, 2 mi SW of Howell, moist ledges (limestone), 15 May 1934, *F. Drouet 1416* (UMO). **St. Clair Co.**: E

bank of Salt Creek just N of Highway B, ca. 4.5 mi E of Oscoela, ledges of sandstone glade, 25 April 1971, *P.L. Redfearn, Jr. 27301* (SMS). **St. Louis City:** right-of-way of the Wabash Railroad, E of Riverview Blvd, one colony, 25 June 1963, *V. Mühlenbach 2115* (MO). **St. Louis Co.:** Allenton, stony woods, 29 May 1918, *J.R. Churchill s.n.* (MO). **Ste. Genevieve Co.:** Pickle Spring, ca. 6 mi E of Farmington, oak forest, narrow sandstone gorges, 8 May 1964, *P.L. Redfearn, Jr., D.M. Eggers, D. Demaree & A.J. Sharp 14465* (SMS). **Shannon Co.:** Welch Spring, crevices of large limestone boulders, 28 May 1962, *P.L. Redfearn, Jr. 10016* (SMS). **Shelby Co.:** along N side of North River, in Miller's Hills, 2.5 mi SE of Burksville, upper slopes and ridges in ravines tributary to and wooded slopes along river, 5 June 1951, *J.A. Steyermark 71711* (F). **Sullivan Co.:** James Broyles farm, 8.2 mi NW of Milan, W of County Highway BB, prairie, 23 Sep 1982, *M.L. Conrad, J. Anderson & D. Broyles 10018* (NEMO). **Warren Co.:** along headwaters of Lost Creek, 3½ mi SW of Warrenton, wooded cherty slopes, 9 June 1946, *J.A. Steyermark 63688* (F). **Wayne Co.:** Sam Baker State Park, wooded slopes along dry rocky creek, open woodland, 9 May 1964, *P.L. Redfearn, Jr. & D.M. Eggers 14526* (SMS). **Wright Co.:** vicinity of Cedar Gap, oak-hickory forest, 17 May 1964, *P.L. Redfearn, Jr. 14727* (SMS).

4. Heuchera villosa Michx. **var. villosa** (maple-leaved alum root)
H. villosa var. *macrorhiza* (Small) C. Rosend., Butters & Lakela

Petioles sparsely to densely pubescent with relatively long, usually woolly hairs some of which have minute glandular tips, lacking minute glandular hairs. Leaf blades 2–19 cm long, circular to broadly ovate-triangular, the upper surface glabrous to moderately pubescent with straight hairs, the undersurface glabrous to moderately pubescent with usually woolly hairs, sometimes somewhat glandular-sticky, the lobes widely to narrowly triangular, the margins usually sharply toothed. Inflorescences 20–75 cm long, erect or ascending, the axes sparsely to densely hairy with woolly hairs to 4 mm long, the ultimate branches with shorter straighter gland-tipped hairs. Hypanthium at flowering 1.5–3.5 mm long, 2–3 mm in diameter, the free portion 0.2–0.5 mm long, appearing actinomorphic or very slightly zygomorphic (sometimes appearing more zygomorphic upon pressing), obconic to bell-shaped when fresh, with minute to short straight gland-tipped hairs on the outer surface, green to yellowish green or whitish green, sometimes reddish-tinged. Sepals 0.5–1.7 mm long, glabrous or with minute gland-tipped hairs on the outer surface and margins, the sinuses between the sepals relatively narrow. Petals 1–3 mm long, linear,

often curled or coiled, usually glabrous, green or white, sometimes pinkish-tinged. Fruits with the body 3.0–6.5 mm long, tapered into the 1.5–3.5 mm long styles. Seeds 0.6–0.9 mm long, ellipsoid, the surface with fine spines, dark brown. $2n$=14. Flowering June to August, occasionally also in November.

Uncommon and probably extirpated, known only from historical sites in Iron County (Map 4) (eastern U.S. west to Illinois and Mississippi; Missouri). Limestone bluffs.

Steyermark (1963) discussed the problems of accepting this species as a member of the flora. The voucher specimens were from cultivated material supposedly gathered from two sites in Iron County and grown in St. Louis in the garden of Albert Chandler. Populations have not been rediscovered in the wild in Missouri, and the Iron County stations are somewhat disjunct from the closest sites in western Kentucky and Tennessee. Steyermark, however, was convinced that plants had occurred in the area suggested by Mr. Chandler, and the species is thus hesitantly included in the present treatment. Wells (1984) accepted the name var. *arkansana* (Rydb.) E.B. Sm. for dwarf plants with very short flower stalks and less hairy, narrower calyces. Interestingly, this variety is considered endemic to just eight counties in the northwestern quarter of Arkansas. Thus, it may eventually be found to occur in adjacent counties in Missouri.

SPECIMENS EXAMINED.—**Iron Co.**: originally collected in 1928 between Annapolis and Sabula, limestone bluffs, specimen collected from plants culti-vated in garden of A. Chandler, 1 Aug 1933, *J.A. Steyermark 7714* (MIN); same data, 3 Nov 1933, *J.A. Steyermark 7714a* (MO); same data, 3 Nov 1933, *J.A. Steyermark 7715* (MO).

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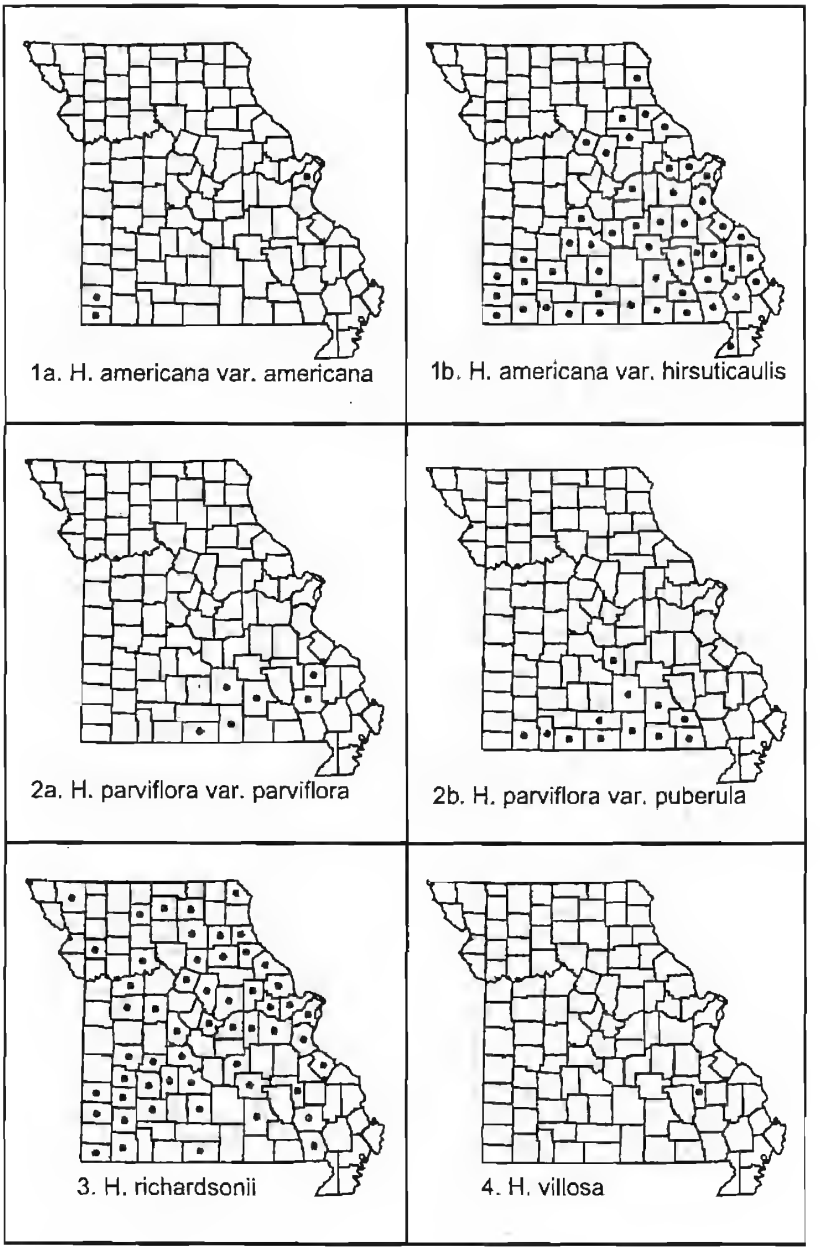
1a. H. americana var. americana
1b. H. americana var. hirsuticaulis
2a. H. parviflora var. parviflora
2b. H. parviflora var. puberula
3. H. richardsonii
4. H. villosa

Maps 1–4. Distributions of *Heuchera* taxa in Missouri.